HANDBOOK OF OPERATION INSTRUCTIONS

FOR THE

Model R-1820-65 Engine and Associated Models

(*R-1820-65, -71, -73, -87, and -97*)

NOTE: This Technical Order replaces T. O. No. 02-35GC-1 dated April 10, 1942. These instructions are to be used for flight purposes only when the Pilot's Handbook of Operating Instructions is not available. Consult Index, T. O. No. 00-1.

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October 10, 1942

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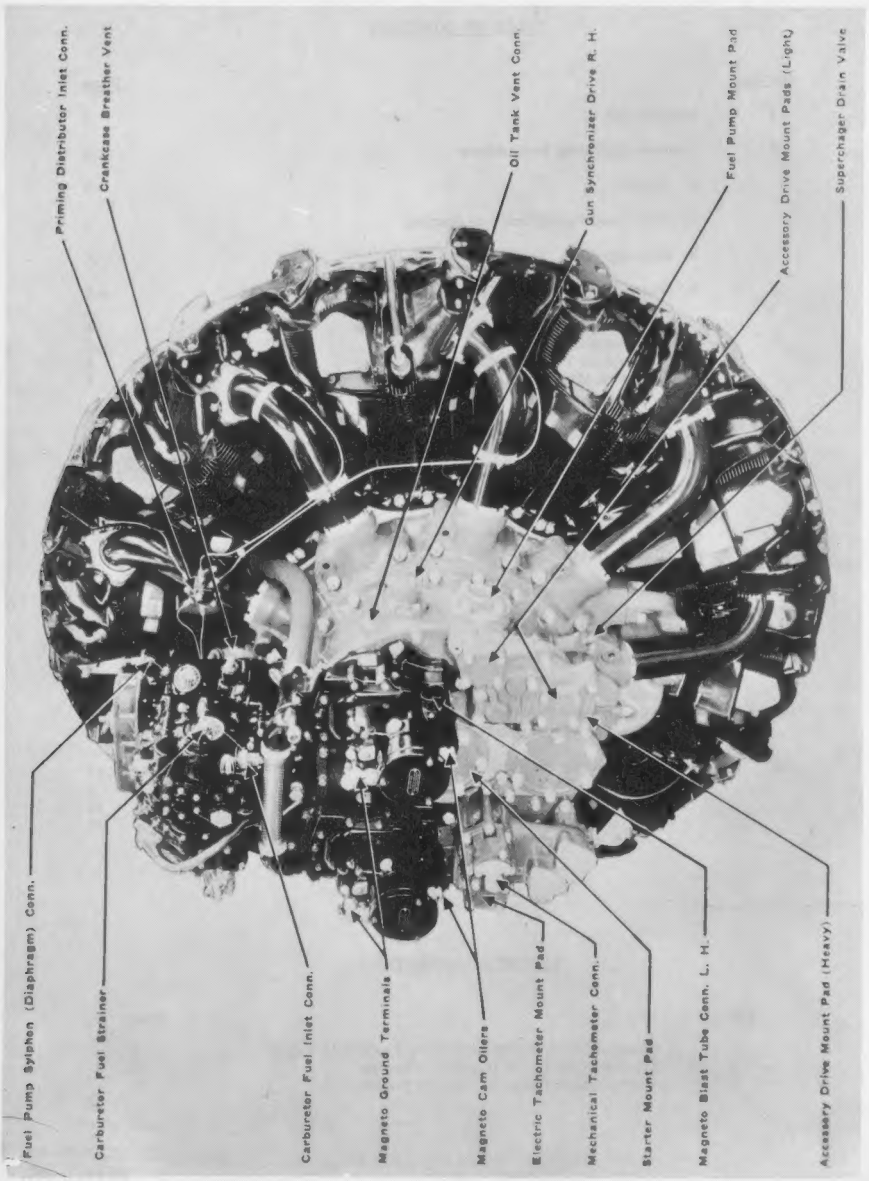

Figure 1 - Three-Quarter Right Rear View R-1820-65 Engine

SECTION I

INTRODUCTION

1. This Technical Order constitutes the Operation Instructions for the Model R-1820-65 Engine and Associated Models, manufactured by Wright Aeronautical Corporation, Paterson, N.J. These instructions will be used for flight purposes only when the Pilot's Handbook of Operating Instructions is not available. Consult the Index, T. O. No. 00-1.

2. The following Technical Orders contain related instructions and are listed only for convenient reference in the event further information is required:

T. O. No.	
02-1-5	Operation of Carburetor Heaters
02-1-7	Detonation in Aircraft Engines
02-1-23	Flight Operation of Aircraft Engines
02-1-29	Ground Operation Instructions for Aircraft Engines
02-35GC-2	Handbook of Service Instructions
03-10BA-2	Service Instructions - Injection Carburetors
03-10D-2	Supercharger Regulator, Type A-7
03-10DA-2	Operation and Service Instructions - Turbine Driven Supercharger
03-10G-1	Operation of Carburetor Mixture Controls
03-20-6	Operation of Propeller Controls During Landing
06-5-1	Fuels - Use and Disposition
06-10-1	Aircraft Engine Lubricating Oil, Grades and Use

SECTION II

GENERAL OPERATING INSTRUCTIONS

1. General.

a. These engines are equipped with Bendix Stromberg Injection Carburetors.

b. Models R-1820-65, -73, and -97 are equipped with turbo-superchargers.

c. Model R-1820-71 is a single-speed supercharger engine and model R-1820-87 is a two-speed supercharger engine.

2. Procedure Preliminary to Starting.

a. Before the engine is started the first time after installation, or whenever the carburetor has been drained, observe the special procedure for cold weather starting outlined in paragraph 3.d. below.

b. Set the oil cooler shutters to the "Closed" position.

c. Open engine cowl flaps.

d. On models equipped with turbo-superchargers, the intercooler shutters should be placed in the "Open" position. Open waste gate, and place supercharger regulator in "Off" position.

e. If the engine has been idle for over two hours or if excessive priming has been used during starting attempts, make certain ignition is off and then turn engine slowly by hand four or five revolutions. If fuel or oil is present in any combustion chamber as evidenced by excessive compression, remove the spark plugs from that cylinder, drain all liquid from the cylinder and intake pipes, dry spark plugs thoroughly before replacing.

f. Move throttle lever almost to "Closed" position (about one-tenth open, equivalent to 600-800 rpm).

g. Set carburetor heater valve at "Closed" or "Cold" position.

h. Set propeller control to "High rpm" (low pitch) position.

i. Set fuel cocks and cross-feed valves, if any, in accordance with airplane operating instructions.

j. Place mixture control in "Idle Cut-Off" position.

k. Turn ignition to "Both" position.

l. Start booster fuel pump or emergency fuel pump for the engine to be started.

3. Starting.

a. Energize starter, and immediately before meshing the starter to the engine, prime engine two strokes to fill the primer lines with fuel. This is not intended as a priming operation, but is to fill primer lines so that priming is effected immediately.

b. Mesh the starter to the engine and at the same time prime the engine with three or four strokes of the primer, and return primer to the locked position.

CAUTION: While booster pump is operating hold the primer in towards the locked position when not in use as boost pressure may be sufficient to release handle and cause flow of fuel in primer lines resulting in a flooding condition.

c. When the engine starts firing, move the carburetor mixture control to the "Auto-Rich" position.

d. During sub-zero weather, if starting difficulty is encountered, move the carburetor mixture control from the "Idle Cut-Off" to the "Auto-Rich" position at the same time the starter is engaged with the engine. If this practice is used, it is essential that the mixture control be moved back to the "Idle Cut-Off" position if the engine does not start during the fourth revolution. This procedure will result in overpriming if extreme caution is not used. Normally the engine will start on the second or third revolution. However, if the engine does not start, turn off the ignition switch and pull the engine through by hand with the carburetor throttles in the wide open position to clear the engine of excess fuel.

e. If the engine fails to start after a reasonable number of attempts, consult the Handbook of Service Instructions, T. O. No. 02-35GC-2, for possible cause.

4. Warm-Up and Ground Test.

a. General. - The following paragraphs prescribe ground tests which will be performed prior to flight.

(1) Any faulty operation or malfunctioning noted during these ground tests will be investigated and the necessary adjustments made prior to take-off.

(2) Limits of 30 inches mercury manifold pressure and not over 2000 rpm will provide a sufficient range of power and speed in ground operation to adequately check magnetos, spark plugs, propeller controls, etc.

(3) If there is any indication of carburetor ice in engines equipped with turbo-superchargers, cooler shutters should be moved toward the "Closed" position sufficiently to preclude its formation.

(4) Adjust the oil cooler shutters as required to maintain specified temperature limits.

(5) Mixture control will remain in the "Auto-Rich" position for all ground operation.

b. Oil Pressure and Temperature Check.

(1) The engines will always be warmed up on the ground until proper lubrication and engine operation for the take-off and flight are assured.

(2) As soon as the engine has started, watch the oil gage for pressure. If the oil pressure gage does not indicate pressure within one-half minute, shut down the engine and make an investigation.

(3) After the oil gage indicates pressure, shift the propeller to take-off setting and run the engine at 600 to 800 rpm until the pressure is normal (a value between 30 and 65 pounds per square inch) for this speed. If oil dilution has not been employed this warm-up will be extended for several minutes, after which the rpm may be increased to 1000.

(4) During the warm-up period, the engine rpm will not be permitted to exceed one-half of the maximum permissible ground rpm until after the engine maintains, without fluctuations, at least two-thirds of the minimum full power oil pressure specified, and the oil temperature gage shows a definite increase in oil temperature, indicating that oil is circulating properly. When these conditions are obtained, and the mixture and propeller controls are set for take-off, the engine rpm may be increased to check for proper functioning of the engine and engine instruments at higher rpm. However, the maximum permissible ground rpm will not be maintained for periods in excess of twenty to thirty seconds. (The maximum permissible ground rpm and manifold pressure will be those specified for "maximum cruising" in section III, except for the turbo-supercharged engines which require setting of "Take-Off" manifold pressure on the ground.) Tightly baffled air-cooled radial engine cylinders quickly reach a cylinder temperature that is beyond the lubricating range of the oil, resulting in the sticking of pistons or rings. Therefore, it is desirable to nose the airplane into the wind during warm-up. Engines will be stopped rather than idled for prolonged periods after warm-up has been accomplished.

c. Ignition System Check.

(1) Note the loss of revolutions or manifold pressure when switched to one magneto at a time. Whenever an engine is operated on only one magneto, the manifold pressure must not exceed maximum cruising manifold pressure to avoid detonation when firing on only one set of spark plugs. The propeller governors must be set to take-off speed and the throttle adjusted to give cruising engine speed or less during the ignition check. It is important to switch back to "Both" and leave switch in that position until the engine has picked up the loss in rpm resulting from operating on one magneto before testing for loss in rpm on the other magneto. The normal loss in rpm when operating on

one magneto should not exceed 100 rpm. The difference in timing of the two magnetos results in a difference in loss in rpm, or manifold pressure, when operating on either magneto alone. This check should be made in as short a time as possible, and should not exceed fifteen seconds.

(2) At the start of the day's flying it is necessary to check the "Off" position of the ignition switch to assure the proper connection of the ground wires. This check should be made at the end of the engine "warm-up" period with the propeller in full low pitch and the engine turning over approximately 700 rpm. The switch should be turned to the "Off" position momentarily to note whether or not the engine stops firing, and immediately returned to the "Both On" position. Two or three seconds is ample time for the switch to remain in the "Off" position.

d. Manifold Pressure Gage Drain. - When warming up the engine, the shut-off cock for the manifold pressure gage drain will be opened for a few seconds to clear the line of liquids and vapors. This will be done at idling speeds only.

e. Clutch Mechanism for Two-Speed Superchargers. - To prevent accumulation of centrifuge sludge and dirt in the two-speed supercharger clutch mechanism, and to check for satisfactory operation, the clutches will be shifted immediately following each engine warm-up. To accomplish the shifting operation, set the propeller governor in full low pitch (high rpm) position, set the engine speed at 1500 rpm, move the supercharger control lever to the "High" position and lock. Open the throttle to obtain not over 30 inches mercury manifold pressure. When the engine speed has stabilized, observe the manifold pressure and immediately shift the supercharger control to the "Low" position without moving the throttle. A sudden decrease in manifold pressure is an indication that the two-speed supercharger drive is operating properly.

5. Take-Off.

a. R-1820-65, -73, and -97 Engines.

(1) Do not start take-off with the cylinder head temperatures above 205 degrees C (401 degrees F).

(2) Adjust oil cooler shutters to "Full Open."

(3) The turbo-supercharger will normally not be used for take-off. However, if it is necessary to use the turbo to obtain the desired take-off manifold pressure, the following instructions will be complied with after warm-up and prior to take-off:

(a) Open throttle on one engine to full throttle. Adjust the waste-gate regulator to obtain take-off manifold pressure, adjust propeller control to obtain take-off rpm, lock the waste-gate regulator control and propeller control, and return the throttle to idling position. Repeat this procedure for each engine.

CAUTION: Warm-up and ground test running of these engines will be held to an absolute minimum.

(b) A minor variation of ± one (1) inch mercury manifold pressure is permissible. In multi-engine airplanes, if one supercharger is used, all should be used.

(4) For take-off leave all other controls set as in warm-up, release wheel brakes and open all throttles simultaneously to full throttle.

(5) Limit full power to one minute unless in an emergency, when full power for a maximum of five minutes is permissible.

b. R-1820-71 and -87 Engines.

(1) Do not start take-off with the cylinder head temperatures above 205 degrees C (401 degrees F).

(2) Adjust oil cooler shutters to "Full Open."

(3) Always take-off R-1820-87 engine in low supercharger ratio.

(4) Limit full power to one minute unless in an emergency, when full power for a maximum of five minutes is permissible.

6. Flight.

a. The rpm, cylinder temperatures, oil temperature and oil pressure give the most satisfactory indication of the engine's performance. If any of these appears irregular, the engine should be throttled, and if the cause cannot be eliminated, a landing should be made to investigate and remove the trouble.

b. To avoid excessively lean mixtures and possible damage, always set mixture control in "Auto-Rich" before shifting fuel supply tanks, and never permit a fuel supply tank to run dry before shifting to an alternate tank.

c. R-1820-65, -73, and -97 Engines.

(1) After take-off, the automatic supercharger regulator should be adjusted to hold the pressure specified for the climb. Normally, to reduce power for climb, the turbo-supercharger control should first be moved toward the "Off" position. When the control is in the "Off" position and a further reduction of power is desired, move the throttle toward the "Closed" position to give the proper manifold pressure.

CAUTION: Excessive supercharging will cause serious damage to the engine.

(2) The following procedure will always govern when changing the condition of power of turbo-supercharged engines.

(a) Increasing Engine Power.

1. Adjust mixture control to obtain the fuel/air ratio specified for the power desired.

2. Adjust propeller control to obtain the desired rpm.

3. Adjust throttle control to obtain the desired manifold pressure.

4. Advance turbo-supercharger regulator if necessary.

5. Readjust mixture control if necessary.

(b) Decreasing Engine Power.

1. Retard turbo-supercharger regulator.

2. Adjust throttle control to obtain the desired manifold pressure.

3. Adjust the propeller control to obtain the desired rpm.

4. Readjust throttle if necessary.

5. Adjust the mixture control to obtain the desired fuel/air ratio.

d. R-1820-71 and -87 Engines.

(1) The following procedure will always govern when changing the condition of power for these engines.

(a) Increasing Engine Power.

1. Adjust mixture control to obtain the fuel/air ratio specified for the power condition desired.

2. Adjust propeller control to obtain the desired rpm.

3. Adjust throttle control to obtain the desired manifold pressure.

4. Readjust mixture control, if necessary.

(b) Decreasing Engine Power.

1. Adjust throttle control to obtain the desired manifold pressure.

2. Adjust propeller control to obtain the desired rpm.

3. Readjust throttle controls, if necessary.

4. Adjust mixture controls to obtain the desired fuel/air ratio.

(2) Additional Instructions for R-1820-87 Engine.

(a) These engines should be operated in low supercharger ratio at altitudes up to the low supercharger critical altitude for the power being used.

(b) Changes from one supercharger ratio to another should be made quickly. The supercharger control must be locked at the end of its travel in either ratio to insure complete engagement of the clutch.

(c) When shifting from low to high supercharger ratio, proceed in the following manner:

1. Set mixture control in "Auto-Rich" position.

2. Partially close the throttle so that the desired high supercharger manifold pressure will not be exceeded.

3. Move the supercharger control rapidly from "Low" position to "High" position and lock.

4. Readjust the throttle setting if the manifold pressure is not at the desired value for high supercharger operation.

5. Readjust the rpm setting only as necessary to obtain desired power.

6. Readjust the mixture control to obtain the desired setting.

(d) When shifting from high to low supercharger ratio, proceed in the following manner:

1. Set the mixture control in "Auto-Rich" position.

2. Quickly move the supercharger control to the extreme "Low" supercharger position and lock before moving throttle.

3. Set the desired manifold pressure with the throttle.

4. Readjust the rpm setting only as necessary to obtain desired power.

5. Readjust the mixture control to obtain the desired setting.

(e) During flight, wait at least five minutes after changing supercharger ratios before making another supercharger ratio change in order to provide opportunities for dissipation of the heat generated during clutch engagement.

7. Landing.

a. Preparatory to landing, controls will be set in the following manner:

(1) The mixture control will be set in "Auto-Rich."

(2) The propeller control will be placed in the maximum cruising rpm position.

b. In the event it is found necessary to interrupt the glide and make another landing approach, the throttle will be adjusted first and then the propeller controls placed in the "High rpm" (low pitch) position.

c. After landing and during taxiing, the propeller controls will be placed in the "High rpm" (low pitch) position.

d. Models R-1820-65, -73, and -97 Engines Only.

(1) With the throttle of one engine set at full throttle, adjust the waste-gate regulator of the turbo-supercharger to obtain 39 inches mercury manifold pressure. Lock the waste-gate regulator control and retard the throttle to desired power for landing approach. Repeat this operation for each engine. Manifold pressure in excess of 39 inches mercury will result in detonation with a resultant loss of power.

(2) Move the throttles gradually to "Closed."

(3) When the airplane is on the ground, move the turbo-supercharger control to "Off."

e. If an emergency arises requiring the use of full engine power, move the throttles to "Full Throttle" and proceed as outlined in paragraph 4.

f. Care should be exercised to prevent overcooling of the engine during long glides.

8. Stopping.

a. Propeller controls will be left in the high rpm position.

b. Allow the engine to run at normal idling speed with the nose cowl or radiator shutters (if installed) fully opened until the engine has cooled appreciably below cruising temperature. Cylinder and oil temperature will normally reach values below cruising temperatures during the gliding for landing and taxiing.

CAUTION: On higher output engines, it may be necessary to idle at a higher speed than the normal idling position to prevent overheating and fouling of plugs on the ground. It may also be necessary to shorten the idling period to a minimum, in order to prevent this overheating. Temperatures must be carefully controlled and must not be permitted to exceed the specified limits.

c. Move throttle to "Full Open" position at the same time that the mixture control is moved to "Full Lean" or "Idle Cut-Off" position in order to remove the accelerating charge from the induction system.

d. Turn ignition switch to "Off" position after engine ceases firing.

e. Mixture control will be left in the "Full Lean" or "Idle Cut-Off" position until engine is started again.

f. Instructions on the use of the oil dilution system may be found in T. O. No. 02-1-29.

9. Mixture Control.

a. Refer to T. O. No. 03-10G-1 for general information including definition of carburetor settings such as "Auto-Rich" referred to herein.

b. Above desired cruising manifold pressure and speed, the mixture control lever shall be set in "Auto-Rich."

c. At or below desired cruising manifold pressure and speed, the mixture control may be set in "Auto-Lean" if fuel economy is important.

CAUTION: When operating at "Auto-Lean" the setting should be changed to "Auto-Rich" immediately before a rapid change in altitude or a change in cruising conditions is made.

d. As the fuel/air ratio is decreased (engine leaned out) cylinder head temperatures may increase. Do not exceed temperatures specified in section III.

10. Turbo-Supercharger.

a. In addition to specific instructions given in this Technical Order, personnel operating aircraft equipped with turbo-superchargers should read and familiarize themselves with the operating instructions contained in T. O. No. 03-10DA-2, and the Handbook of Instructions for type A-7 supercharger regulators, T. O. No. 03-10D-2.

b. If the turbo-supercharger is turned off at high altitudes, difficulty may be encountered in restarting the turbine because of lack of heat applied to the turbine wheel. To restart the turbo at high altitudes, turn the supercharger control to the "Off" position; open the throttle to "Full Throttle"; adjust the propeller control to the "High rpm" position; lean the fuel/air ratio and adjust manifold pressure to the desired values. In order to avoid damage to the engine because of too-lean fuel/air ratios, the preceding setting should be made as quickly as possible. Turn supercharger control "Full On," enrich mixture control, then adjust rpm and manifold pressure to desired values.

c. During some conditions of flight such as in icing conditions or low altitude flight, it may be desirable to operate the engine at part throttle while using the turbo-supercharger. Under those conditions extreme caution must be exercised if the throttle is opened farther, in order that excessive manifold pressures will not be obtained.

d. The carburetor air temperature should be maintained between 15 degrees C and 35 degrees C (59 degrees F and 95 degrees F). Where the above temperatures cannot be maintained with the intercooler heat control in the "Hot" position, advantage may be taken of the heat of compression of the turbo-supercharger. To obtain the maximum carburetor air heat from the supercharger move the supercharger control toward the "On" position and the throttle toward the "Closed" position to maintain desired manifold pressure. Under these conditions extreme caution should be exercised if the throttle is opened farther in order that excessive manifold pressure will not be obtained.

11. Fuel and Oil.

a. The grade of fuel to be used in the operation of these engines is specified in section III. Refer to T. O. No. 06-5-1 for general information on the use and disposition of fuels.

b. General information on lubricants for these engines may be found in T. O. No. 06-10-1.

12. Detonation.

a. General. - Refer to T. O. No. 02-1-7 for general information and instructions pertaining to detonation in aircraft engines.

b. Indications of Detonation.

(1) Engine roughness does not necessarily indicate that detonation is present but when unusual roughness is encountered it may be due to detonation.

(2) An increase in cylinder temperature due to detonation, if apparent, would first be noticed on the cylinder head thermocouples. Cylinder temperatures, however, cannot be relied on for a definite and complete indication of detonation.

(3) An erratic reading of the fuel/air ratio meter may indicate detonation and should be investigated. If, as the mixture is leaned out, the indicating needle does not show a leaner mixture, or backs up on the scale towards the rich side, detonating has probably been encountered.

(4) If exhaust stacks are visible, detonation may be indicated by intermittent puffs of dense black smoke, often accompanied with sparks or glowing carbon, in contrast to the indications of a rich mixture which is generally indicated by dull red flames with steady black smoke.

c. Causes and Prevention.

(1) Use of fuel of too-low octane rating. See that proper grade of fuel is used.

(2) A too-low fuel/air ratio. Do not operate at mixtures that are too lean.

(3) Operating engine above permissible limitations. Observe specific instructions in section III.

d. Stopping Detonation Immediately if Present.

(1) Reduce the manifold pressure.

(2) Enrich the mixture.

(3) Reduce the carburetor air preheating to the minimum temperature at which icing of the carburetor may be prevented.

SECTION III
SPECIFIC OPERATING INSTRUCTIONS

ENGINE: R-1820-65, -73 and -97

CONDITION	FUEL PRESSURE LB/IN.²	OIL PRESSURE LB/IN.²	OIL TEMP °C	COOLANT TEMP °C
DESIRED	14	70	70	-
MAXIMUM	16	75	85	-
MINIMUM	12	65		-
IDLING	12	15		

MAX. PERMISSIBLE ENGINE OVER SPEED: 2760 R.P.M.

MAX. ALLOWABLE OIL CONSUMPTION AT:

NORMAL RATED POWER 14.0 QTS./HR.
MAXIMUM CRUISING 8.0 QTS./HR.
MINIMUM SPECIFIC FUEL FLOW 5.0 QTS./HR.

FUEL GRADE 100 OCTANE

⊕ OPERATING CONDITION	HORSE POWER	R.P.M.	MAN. PRESS. (IN. HG)	PRESSURE ALTITUDE (IN FEET)	BLOWER CONTROL POSITION	USE LOW BLOWER BELOW	MIXTURE CONTROL POSITION	MIN. F/A RATIO	FUEL FLOW GAL/HR	MAX. CYL. HD. TEMP. °C	REMARKS
TAKE-OFF	1200	2500	46.0	Sea Level	Turbo	-	Auto-Rich	-	-	260°C	5 Minute Duration Only
MILITARY RATED POWER	1200	2500	46.0	Sea Level to 25,000	Turbo	-	Auto-Rich	.113	152	260°C	5 Minute Duration Only Retard turbo 1 in. Hg Press. each 1000 ft. above 25,000.
⊛ NORMAL RATED POWER (100%)	1000	2300	39.5	Sea Level to 25,000	Turbo	-	Auto-Rich	.095	110	218°C	Retard turbo 1 in. Hg Press. each 1000 ft. above 25,000.
MAX. CRUISING (75%)	750	2000	33.0	Sea Level to 25,000	Turbo	-	Auto-Rich	.076	62	205°C	-
DESIRED CRUISE (67%)	670	2000	30.5	Sea Level to 25,000	Turbo	-	Auto-Rich	.070	52	205°C	-
DESIRED CRUISE (60%)	600	1940	28.5	Sea Level to 25,000	Turbo	-	Auto-Lean	.068	44	205°C	-
CRUISE FOR MIN. SPECIFIC FUEL FLOW	340	1300	27.5	Sea Level	Turbo	-	Auto-Lean	.067	26	205°C	-
	365	1300	°F.T.	5,000	Turbo	-	Auto-Lean	.067	28	205°C	*Full Throttle
	395	1460	24.0	10,000	Turbo	-	Auto-Lean	.067	30	205°C	-
	425	1750	24.0	15,000	Turbo	-	Auto-Lean	.067	31	205°C	-
	465	1800	25.0	20,000	Turbo	-	Auto-Lean	.067	34	205°C	-

⊕ REFER TO T.O. NO. 00-10 FOR DEFINITION OF EACH OPERATING CONDITION ⊛ MAXIMUM PERMISSIBLE CONTINUOUS HORSE POWER

SECTION III
SPECIFIC OPERATING INSTRUCTIONS

ENGINE: R-1820-71

CONDITION	FUEL PRESSURE LB/IN.²	OIL PRESSURE LB/IN.²	OIL TEMP. °C	COOLANT TEMP. °C
DESIRED	14	70	50-70	-
MAXIMUM	16	75	85	-
MINIMUM	12	65		-
IDLING	12	15		

MAX. PERMISSIBLE ENGINE OVER SPEED: 2760 R.P.M.

MAX. ALLOWABLE OIL CONSUMPTION AT:

NORMAL RATED POWER 14.0 QTS./HR.

MAXIMUM CRUISING 11.0 QTS./HR.

MINIMUM SPECIFIC FUEL FLOW 7.0 QTS./HR.

FUEL GRADE 100 OCTANE

⊕ OPERATING CONDITION	HORSE POWER	R.P.M.	MAN. PRESS. (IN. HG)	PRESSURE ALTITUDE (IN FEET)	BLOWER CONTROL POSITION	USE LOW BLOWER BELOW	MIXTURE CONTROL POSITION	MIN. F/A RATIO	FUEL FLOW GAL/HR	MAX. CYL. HD. TEMP. °C	REMARKS
TAKE-OFF	1200	2500	45.5	Sea Level	-	-	Auto-Rich	-	-	260°C	5 Minute Duration Only
MILITARY RATED POWER	-	-	-	-	-	-	-	-	-	-	-
◉ NORMAL RATED POWER (100%)	1000	2300	37.0	6,900	-	-	Auto-Rich	.095	110	218°C	-
MAX. CRUISING (75%)	750	2000	31.0	6,900	-	-	Auto-Rich	.076	62	205°C	-
DESIRED CRUISE (67%)	670	2000	28.5	6,900	-	-	Auto-Rich	.068	53	205°C	-
DESIRED CRUISE (60%)	600	1940	26.4	6,900	-	-	Auto-Lean	.065	47	205°C	-
CRUISE FOR MIN. SPECIFIC FUEL FLOW	600	1400	32.0	Sea Level	-	-	Auto-Lean	.065	47	205°C	-
	600	1450	31.0	5,000	-	-	Auto-Lean	.065	47	205°C	-
	600	1600	28.0	10,000	-	-	Auto-Lean	.065	47	205°C	-
	600	1850	25.0	15,000	-	-	Auto-Lean	.065	47	205°C	-
	600	1850	°F.T.	20,000	-	-	Auto-Lean	.065	47	205°C	* Full Throttle

⊕ REFER TO T.O. NO. 00-10 FOR DEFINITION OF EACH OPERATING CONDITION ◉ MAXIMUM PERMISSIBLE CONTINUOUS HORSE POWER

SECTION III
SPECIFIC OPERATING INSTRUCTIONS

ENGINE: R-1820-87

CONDITION	FUEL PRESSURE LB/IN.²	OIL PRESSURE LB/IN.²	OIL TEMP °C	COOLANT TEMP °C
DESIRED	14	70	50-70	
MAXIMUM	16	75	85	
MINIMUM	12	65		
IDLING		15		

MAX. PERMISSIBLE ENGINE OVER SPEED: 2760 R.P.M.

MAX. ALLOWABLE OIL CONSUMPTION AT:

NORMAL RATED POWER 14 QTS./HR.
MAXIMUM CRUISING 10 QTS./HR.
MINIMUM SPECIFIC FUEL FLOW 5 QTS./HR.

FUEL GRADE 100 OCTANE

⊕ OPERATING CONDITION	HORSE POWER	R.P.M.	MAN. PRESS. (IN. HG)	PRESSURE ALTITUDE (IN FEET)	BLOWER CONTROL POSITION	USE LOW BLOWER BELOW	MIXTURE CONTROL POSITION	MIN. F/A RATIO	FUEL FLOW GAL/HR	MAX. CYL. HD. TEMP. °C	REMARKS
TAKE-OFF	1200	2500	45.5	S. L.	Low	Always Use Low Blower	Auto Rich	-	144	260	5 min. duration only.
MILITARY RATED POWER	1200 1000	2500 2500	43.0 44.5	4200' 14,200'	Low High	10,000	Auto Rich	-	144 127	260	5 min. duration only.
⊛ NORMAL RATED POWER (100%)	1000 900	2300 2300	37.2 40.0	6900' 15,200'	Low High	10,500	Auto Rich	-	112 114	232	
MAX. CRUISING (75%)	750 675	2020 2020	30.5 32.0	6900' 15,200'	Low High	14,000	Auto Rich	-	63 66	205	
DESIRED CRUISE (67%)	670 603	2020 2020	28.0 29.0	6900' 15,200'	Low High	16,500	Auto Lean	-	53 55	205	
DESIRED CRUISE (60%)	600 540	1940 1940	26.0 26.5	6900' 15,200'	Low High	17,500	Auto Lean	-	46 47	205	
CRUISE FOR MIN. SPECIFIC FUEL FLOW	285 307 332 360 390	1300 1300 1300 1300 1500	23.0 22.0 21.0 20.5 22.0	S. L. 5000 10,000 15,000 20,000	Low Low Low Low High	17,000	Auto Lean	-	24 26 28 30 33	205	

⊕ REFER TO T.O.NO 00-10 FOR DEFINITION OF EACH OPERATING CONDITION ⊛ MAXIMUM PERMISSIBLE CONTINUOUS HORSE POWER

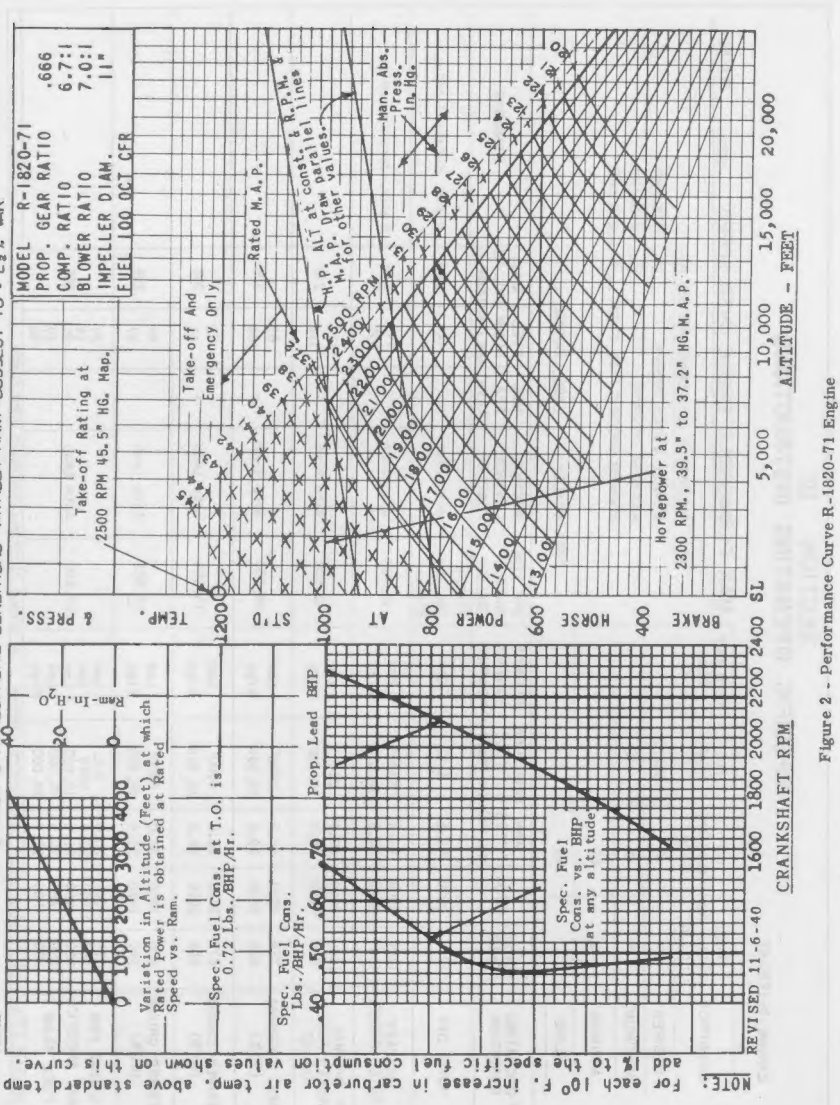

Figure 2 - Performance Curve R-1820-71 Engine

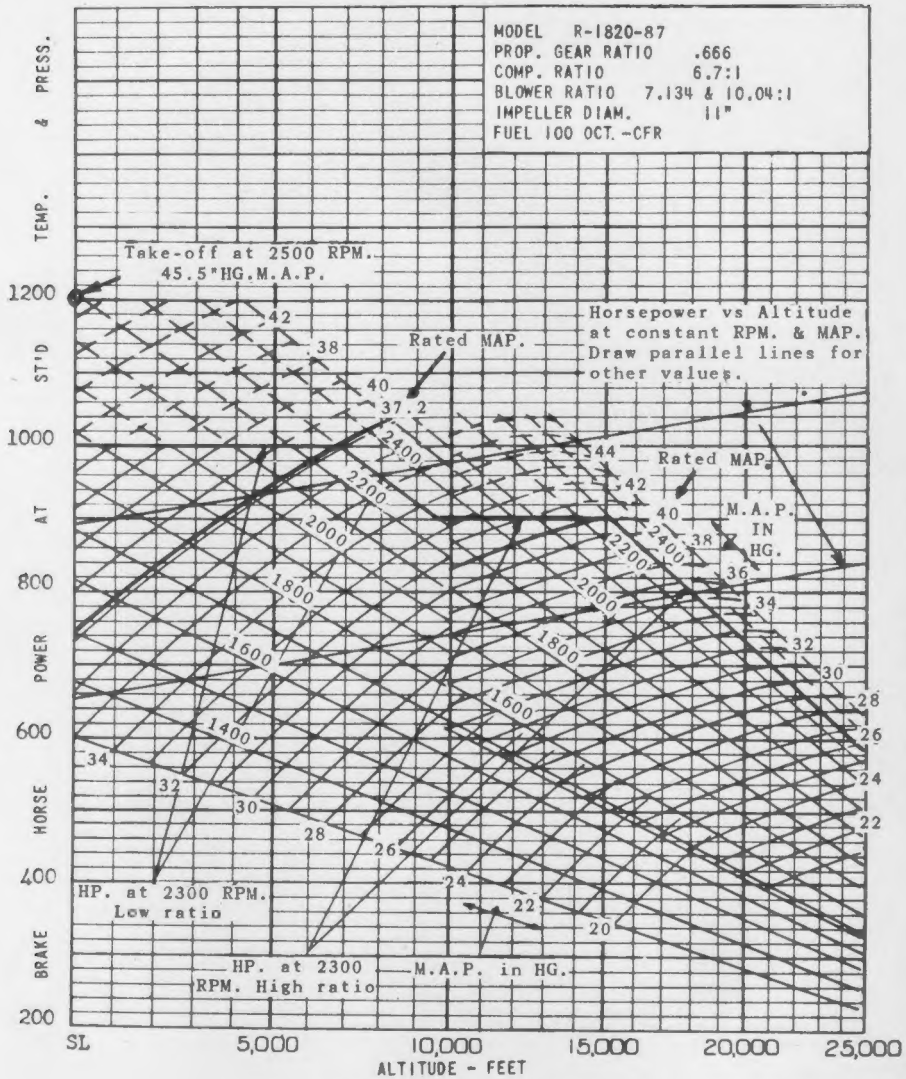

Figure 3 - Performance Curve R-1820-87 Engine